

REPORT NO. 80-2-7

April 1980
3430

EVALUATION OF SOUTHERN PINE BEETLE INFESTATIONS
ON THE NATCHEZ TRACE PARKWAY IN MISSISSIPPI

by

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INTRODUCTION

On January 28 and 29, 1979, a biological evaluation was conducted on the Natchez Trace Parkway in Mississippi. The evaluation, including aerial survey and on-site examination, was conducted by personnel of Forest Insect and Disease Management, State and Private Forestry, U.S. Forest Service. The purpose of the evaluation was to determine the current status of the southern pine beetle (Dendroctonus frontalis Zimm.) activity within the Natchez Trace Parkway.

TECHNICAL INFORMATION

The southern pine beetle attacks all species of southern yellow pine. On the Natchez Trace Parkway, loblolly pine, Pinus taeda L., and shortleaf pine, Pinus echinata Mill., are the preferred hosts.

Type of Damage - Damage caused by the southern pine beetle is tree mortality resulting from adult beetles constructing egg galleries in the cambial region of the host trees. Blue-staining fungi (Ceratocystis spp.), introduced by the beetles and secondary insects, accelerate the kill by blocking the vascular system of the tree.

Life Cycle of the Insect - The beetles attack and construct winding egg galleries in the cambium. Eggs are deposited along the galleries. White larvae hatch from the eggs and further mine the cambium and then construct pupal cells in the outer bark. After transforming to adults, the beetles emerge. During the warmer months, the life cycle is completed in about 30 days. There may be as many as seven generations each year.

METHODS

Aerial Survey and Ground Checks

Southern pine beetle spots were observed from the air and ground checked to determine the number of trees currently infested with SPB. Numbers of infested trees and basal area were recorded at all SPB spots that were ground checked.

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RESULTS

Aerial and Ground Surveys

The aerial survey was conducted by personnel of Forest Insect and Disease Management (FI&DM) located at the Doraville Field Office, Doraville, Ga. The survey was done November 27 and 28, 1979. A total of 102 SPB spots were observed on the Natchez Trace Parkway. The spots ranged in size from 5 - 150 red and fading trees. Forty-six spots were in the 1 - 25 tree size class, 25 were in the 26 - 50 tree size class, 2 were in the 51 - 100 tree size class, and 29 spots were in the 100+ tree size class.

Nineteen spots were ground checked by personnel of FI&DM located at the Alexandria Field Office, Pineville, La. Ground check data is summarized in table 1. Only one spot was inactive. In the 18 active spots, the number of SPB infested trees ranged from 2 - 127, with an average of 187 ft²/ac.

Hazard Rating^{2/}

Hazard rating techniques take into consideration site and stand characteristics and SPB preferences to determine the potential of a particular area having SPB infestations. In general, any forest stand characteristics which cause tree stress will increase the chances of SPB attack. Some of these characteristics are: pine basal areas greater than 120 ft²/ac, pure stands of species susceptible to SPB attack, soil or site characteristics that result in frequent drought or flooding, and increasing stand age (older trees are more likely to be less vigorous).

Nine of the spots were hazard rated (Mason 1979) during the ground check. This provided an indication of the potential for SPB infestations on the Parkway. Final results of hazard rating are shown in table 1. Note, especially, the high basal areas for the Parkway. Also, for the spots rated, none had a low hazard rating.

DISCUSSION

No attempt was made to predict SPB mortality for 1980. The methodology normally used for predicting SPB losses cannot be used during the winter months. However, biological evaluations done in the vicinity of the Natchez Trace Parkway (the Tombigbee National Forest and Holly Springs National Forest) predicted FY 80 SPB caused mortality would be at least one and one-half times greater than FY 79 mortality. This does not mean the Parkway will experience the same magnitude of losses; however, it does seem likely that SPB activity will remain at similar levels and will continue to be a management concern.

^{2/}This methodology has been tested in east Texas, but is being used on a trial basis in other area. Further analysis and evaluation must be made before using on an operational basis.

Table 1. Summary of ground check data for the Natchez Trace Parkway,
January 1980

Spot No.	Number of Infested trees	Pine	Total	Hazard Rating ^{a/}
1.	7	100	210	high
2.	60	140	180	very high
3.	0 ^{b/}			
4.	7	150	220	
5.	127	130	190	very high
6.	16	100	130	moderate
7.	8	110	130	moderate
8.	2	60	60	
9.	20 ^{c/}	140	170	moderate
10.	40	190	220	
11.	21	170	230	
12.	19	210	250	very high
13.	11	70	130	
14.	67	200	270	very high
15.	26	120	170	moderate
16.	34	170	220	
17.	32 ^{d/}	240	250	
18.	11	140	140	
19.	19	150	190	
$\bar{x} = 28$		$\bar{x} = 144$		$\bar{x} = 187$

^{a/} This methodology has been tested in east Texas, but is being used on a trial basis. Further analysis and evaluation must be made before using on an operational basis.

^{b/} Spot inactive on Parkway; private landowners cutting spot.

^{c/} Figure could be low due to poor visibility.

^{d/} Spot moved onto private land.

At this time, the insecticides Lindane and Dursban are registered for use in specific situations to prevent SPB attack of uninfested trees. There are also some silvicultural measures which can be taken which would reduce the chances of SPB attack, but these require stand manipulation. Some of these are: thinning to reduce basal areas, planting which matches pine species to site, and removal of old growth trees. After SPB has attacked an area, there are several alternatives available which will reduce the number of trees killed. Following is a list of alternatives available to the Parkway for the management of southern pine beetle losses. A description of the implementation and the management implications of choosing each alternative is presented.

Alternative 1. Do nothing and allow the infestation to follow a natural trend.

SPB populations increase periodically. When they increase, large numbers of susceptible pine species are killed. This occurs for several years and then the SPB population and the corresponding pine mortality will decrease. This will continue periodically until total transition to a climax forest occurs.

Some cutting will have to be conducted even if this alternative is chosen. Dead trees will begin to decay and eventually fall down. This will pose an attractive nuisance in an area with SPB mortality. Therefore, any dead trees near the edge of roads or in high-use areas should be cut. An example of this would be Bullen Creek, where dead trees along a public trail could fall on someone.

Alternative 2. Remove trees through salvage.

Salvage is the method most often used for stopping the growth of existing spots. This strategy involves removing a buffer strip of noninfested trees, all green infested and red infested trees, and if desired, the trees already killed by the beetles. Costs associated with removing uninfested trees are not charged to specifically designated SPB Project Control Funds since removing uninfested material is not needed for successful control even though it may be operationally desirable. The SPB spot should be carefully surveyed and all trees to be removed should be marked.

To implement this alternative, the buffer strip should be cut first. The buffer strip consists of uninfested trees surrounding the green infested trees. It can vary in size from 10 - 70 ft. There are three major reasons for cutting the buffer strip. They are to insure that: 1) green infested trees which may have escaped detection are removed from the stand, 2) any delay between marking the spot and harvesting does not result in the spot spreading beyond its marked boundaries, and 3) to insure beetle activity in the area is disrupted.

The size of the buffer strip needed to prevent spots from starting again depends on three factors:

- (1) The length of time it will take to remove or treat the trees in a spot.

One of the major reasons for cutting the buffer strip is to be certain all infested trees are removed. If it takes several days to remove all the infested trees, beetles will have emerged and attacked new trees. Therefore, the longer it will take to remove infested trees, the larger the buffer needed.

2) The size of the original spot.

Larger spots have larger beetle populations. If more beetles are present, it is more difficult to control a spot and a larger buffer strip is needed. Also, it will take longer to remove the larger number of infested trees, so a larger buffer will be needed.

3) The intensity of survey after the spot is cut.

If the spot is infrequently checked after cutting is conducted, the larger the buffer strip needs to be. If the 10-ft buffer strip is chosen, the area should be checked at least every other day for a period of 2 weeks. This applies to summer treatments. During cool winter months, it is not necessary to check the spots as often (only once or twice a week is necessary); however, the area should be checked for at least 4 weeks after cutting.

After the buffer strip is cut, all infested trees should be felled toward the center of the spot and removed to prevent beetles from emerging and attacking new trees. Infested trees should be cut as quickly after marking as possible to reduce the chances of beetles emerging and attacking new trees. The reason for felling infested toward the spot center is to keep them as far away from noninfested trees as possible. This reduces the chance of beetles killing additional trees.

If infested trees are removed and stored for firewood, special care should be taken. Beetles that emerge before the wood is burned could fly to any nearby pines and start a new spot. If the wood will not be burned before the beetles emerge, it should not be stored near uninfested trees, unless it is debarked. Infested bark should be burned immediately to kill its brood. (In the summer, it is possible for SPB to develop from egg to adult in 25 days. In the winter it may take 2-3 months for the beetles to develop.) Do not use any insecticide-treated trees for firewood. Toxic fumes may be produced when insecticide-treated trees are burned.

After cutting is finished, the area should immediately be checked to determine if any infested trees were missed. If any newly infested trees are found, they should be cut. The area should then be checked for newly infested trees at least every other day for a period of 2 weeks. This needs to be done to insure the spot does not start again. The smaller the buffer strip, the more important it is to intensively survey the area after cutting. The spot could start again if any infested trees were missed at the time of cutting. If any infested trees are found, they should immediately be removed and the spot checked at least every other day for another 2 weeks.

The limitations of this procedure are: 1) other trees may be mechanically damaged during the salvage operation, 2) the soil will be disturbed, 3) the removal of infested pines will slow down progress towards the last phase of forest succession which is a climax hardwood forest (conversely, the beetles are speeding it up).

Alternative 3. Removal of only infested and buffer trees.

This is similar to Alternative 2, except only the buffer strip and currently infested trees would be cut. Size of the buffer strip and cutting priorities and methods would be the same as in Alternative 2. All vacated trees would be left standing. This would favor parasites and predators (including woodpeckers).

The limitations would be the same as Alternative 2. However, since fewer trees will be removed, there will be less logging impact to the site and less chance of damaging the residual stand.

Alternative 4. Cut-and-leave infested trees.

This is accomplished by felling a 70 ft buffer strip and all infested trees toward the center of the spot. The purpose is to stop spot growth. Use of this method causes beetles to disperse at a time of year when this behavior is unnatural. This results in a reduction of mass attacked trees and spot growth ceases.

The limitations with this control practice are: 1) it can only be used in the summer (May 1 - September 30) since these are the only months beetles are not dispersing, 2) it should only be used on small spots, normally 40 infested trees or less, and 3) this method has proven effective in Texas, but is still being evaluated in other areas, including Mississippi.

Alternative 5. Chemically treat infested trees.

In this method, infested trees are felled toward the center of the spot, cut into workable lengths, and sprayed with Lindane or Dursban® 4E. The buffer strip and vacated trees are not treated. The purpose of this method is to kill the beetle population. Also note, chemical treatments can be used in conjunction with Alternatives 2 and 3 when infested trees cannot be removed prior to beetle emergence.

In high-value areas, such as campgrounds or picnic areas, standing trees around the infested trees may be treated to prevent SPB attack. The insecticides Lindane and Dursban are registered for this purpose. A hydraulic sprayer should be used to apply insecticides to standing trees. The trunk should be sprayed as high as possible and until runoff occurs.

Limitations to this method are: 1) to be effective, all bark surfaces must be sprayed (this involves turning the logs which will be difficult due to the size of the trees involved) until runoff occurs, and 2) the temporary depression of nontarget organisms around the sprayed trees.

Forest Insect and Disease Management, Pineville, LA (phone 318-473-7280, FTS 497-7280) should be contacted prior to the extensive use of chemical control for an update on latest restrictions or application procedures.

RECOMMENDATIONS

Since the Natchez Trace Parkway is a very narrow strip of land with other land ownership on either side, SPB can easily immigrate and emigrate between the two. Therefore, it would be impossible to suppress SPB on the Natchez Trace Parkway through removal of active infestations unless infestations on the adjoining land were also treated.

It would be possible to reduce SPB losses by using any of Alternatives 2-5. It is our understanding that the Natchez Trace Parkway's management direction is to minimize human disturbance in the area. Therefore, if the Natchez Trace Parkway decides to control some SPB infestations, Alternatives 3, 4, or 5 may best meet current management objectives. Also, due to limited land ownership, it might be better for the Parkway to identify high-value areas or high-value pine stands which should be protected from SPB losses. Efforts to minimize SPB losses could then be concentrated on these areas.

Alternative 3, remove only infested trees and buffer should be used if time and manpower are not considerations and the primary consideration is to keep the number of trees removed to a minimum. Also, if infested trees are to be removed from a treated area, this alternative should be chosen to minimize effects to the residual stand. Removing the smallest buffer strip will result in the least damage to the stand. However, smaller buffer strips will require a greater amount of time and manpower after the spot is treated to insure the spot does not start again.

Alternative 4, cut-and-leave, would probably be quicker to use in larger stands of trees. However, more trees will be affected using this alternative than with the other alternatives because it will be necessary to fell a 70 ft buffer strip. Also, remember it can only be used from May to October.

Alternative 5, chemical treatment, may be used advantageously in high value areas where site disturbance must be minimized. It can also be used in conjunction with Alternative 3 when removal of infested trees would create intolerable site disturbance. If the Parkway decides to initiate SPB suppression measures FI&DM is available to provide training.

REFERENCE

Mason, Garland.

1979. Development, modification, and verification of hazard models for the southern pine beetle. Progress Rept. Co-op Agreement No. 42-290. 11 pp.